

# Petr Stepanov

Material science. Gamma spectroscopy. Positron spectroscopy.

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## Objective

Highly motivated Ph.D. graduate with expertise in gamma spectroscopy, positron annihilation spectroscopy, microscopy, and nuclear physics. A strong background in computational techniques, web applications, and desktop software development. More than five years in user interface and user experience design.

Graduated from [BGSU](#) in May 2020. Seeking to either become an effective member of a research group as a post-doctorate fellow or find a steady position in the industry. Authorized to work in the US on [Optional Practical Training \(OPT\)](#) in the following areas: physics, chemistry, and computer science. Will consider [visa sponsorship \(H1B\)](#) offers.

## Education

### Bowling Green State University

Aug 2014 → May 2020

*Bowling Green, OH, USA*

Doctor of Philosophy in photochemical sciences. Dissertation topic: New developments in positron annihilation spectroscopy techniques—from experimental setups to advanced processing software. [View dissertation manuscript](#).

Under the guidance of Dr. Selim I have successfully assembled and maintained Doppler and lifetime positron spectrometers from ORTEC and Canberra units. My research was aimed at the application of Doppler and lifetime positron spectroscopy techniques to study the following effects in materials:

- Defects and grain sizes in solids.
- Kinetics of positrons and positronium atoms in nano-powders.
- Oxidation and ortho-para conversion of positronium atoms in liquids.

Single-photon counting techniques with HPGe and scintillation-based detector systems. Preparing sources of positron radiation and inventorying the radioactive materials.

Additionally, I have developed several open-source desktop GUI software solutions for fitting and interpretation of the raw positron experimental spectra. Software is written in C++ and extensively utilized the CERN ROOT and RooFit frameworks.

### British Higher School of Art and Design

Dec 2011 → Feb 2012

*Moscow, Russia*

Intensive: graphical design and visual communications.

### National Research Nuclear University

Sep 2004 → Feb 2011

*Moscow, Russia*

Bachelor and Master of Science in solid-state physics.

Thesis topic: Defect studies of neutron-irradiated nuclear power plant vessel steels by means of positron annihilation spectroscopy.

## Work experience

### Research Collaborator

Jul 2020 → now

*Thomas Jefferson National Accelerator Facility (JLab), Newport News, VA USA*

Developments in High Energy Physics (HEP). Programming computer simulations of interactions of high energy particles with matter. Statistical analysis of scientific experimental data.

## Postdoctoral Researcher

Jul 2020 → now

Catholic University of America (CUA), Washington, DC, USA

Developing and maintaining Electron Ion Collider (EIC) software. Running computer simulations with CERN ROOT and Geant4. Mentoring undergraduate CUA students.

## Freelance UI/UX Designer and Frontend Developer

Aug 2014 → now

Working on branding identity guidelines for a number of startups. Designing interactive prototypes and writing agile user stories. Slicing mockups into interactive HTML and responsive CSS. Creating micro-interactions: CSS animations and transitions.

Contributing to the frontend part. Working on gulp build scripts, writing SCSS from scratch. Mostly worked with applications with Node.js, EJS, Mongo.DB and modular JavaScript.

As a part of a team worked on cross-platform mobile applications with Ionic framework.

## Research Assistant, Software Developer

Aug 2014 → May 2020

Bowling Green State University (BGSU), Bowling Green, OH, USA

Material science research, interaction of ionizing radiation with matter, radiation defects in solids, radiation chemistry. Gamma-spectroscopy. Positron annihilation spectroscopy. Maintaining and tune-up of fast-timing ORTEC and Canberra electronics. Manufacturing of the radioactive positron sources.

Developing desktop software solutions (C++, ROOT) for acquisition, storing and treatment of raw experimental data and development and verification of theoretical models: [TLIST Processor](#), [SW Calculator](#), [RooPositron](#). GNU Automake, C++, CERN ROOT and RooFit libraries, Java and Swing.

Created websites for international conferences with registration and payment system workflow (WordPress, PHP, Recurly.js). Designed and programmed the [SelimLab](#) research group website (Hexo, Gulp, Bootstrap).

## Web Designer, Frontend Developer

Apr 2011 → Aug 2014

Gridnine Systems, Moscow, Russia

Prototyping conceptual wireframes and visual mockups for web applications (Photoshop, Illustrator).

Developing frontend part of a number of corporate web applications (Google Web Toolkit, JavaScript, Backbone.js and Require.js). Responsive layout with SASS and LESS. Doing some server-side backend programming (Java).

## Computer Science Teacher

Oct 2009 → May 2011

Phys-Tech College at Moscow Institute of Physics and Technology (MIPT), Moscow, Russia

Provided instruction and guidance to high school students on following computer courses: advanced C++ programming, markup on the web, Photoshop and 3D Studio Max.

## Research Scientist

Sep 2008 → Apr 2011

Institute for Theoretical and Experimental Physics (ITEP), Moscow, Russia

Application of positron lifetime spectroscopy for studying the radioactive-induced defects in steels. Monte-Carlo particle simulations with Fortran 95. Maintaining software for CAMECA tomographic atom probe (MSVC). Application of CERN ROOT libraries for fitting and analysis of experimental spectra.

# Recent publications

- Stepanov, P. S.; Selim, F. A.; Stepanov, S. V.; Bokov, A. V.; Ilyukhina, O. V.; Duplâtre, G.; Byakov, V. M. Interaction of positronium with dissolved oxygen in liquids. *Physical Chemistry Chemical Physics* **2020**. DOI: [10.1039/C9CP06105C](https://doi.org/10.1039/C9CP06105C)
- Stepanov, P. S.; Selim, F. A.; Stepanov, S. V.; Byakov, V. M. A Model for Joint Processing of LT and CDB Spectra of Dielectric Nano-sized Powders. *AIP Conference Proceedings* **2019**, 2182 (1), 040004. DOI: [10.1063/1.5135836](https://doi.org/10.1063/1.5135836)
- Stepanov, P. S.; Selim, F. A.; Stepanov, S. V.; Byakov, V. M. Positron and positronium in Al<sub>2</sub>O<sub>3</sub> nanopowders. *AIP Conference Proceedings* **2019**, 2182 (1), 050008. DOI: [10.1063/1.5135851](https://doi.org/10.1063/1.5135851)
- Zhang, L.; Wu, J.; Stepanov, P.; Haseman, M.; Zhou, T.; Winarski, D.; Saadatkia, P.; Agarwal, S.; Selim, F. A.; Yang, H.; et al. Defects and solarization in YAG transparent ceramics. *Photonics Research* **2019**, 7 (5), 549 DOI: [10.1364/prj.7.000549](https://doi.org/10.1364/prj.7.000549)
- Saadatkia, P.; Stepanov, P.; Selim, F. A. Photoconductivity of bulk SrTiO<sub>3</sub> single crystals at room temperature. *Materials Research Express* **2018**, 5 (1), 016202 DOI: [10.1088/2053-1591/aaa094](https://doi.org/10.1088/2053-1591/aaa094)
- Stepanov, S.; Byakov, V.; Duplâtre, G.; Stepanov, P.; Bokov, A. Track Effects in Positronium Formation. *Acta Physica Polonica A* **2017**, 132 (5), 1461–1466 DOI: [10.12693/aphyspola.132.1461](https://doi.org/10.12693/aphyspola.132.1461)

- Stepanov, P.; Stepanov, S.; Byakov, V.; Selim, F. Developing New Routine for Processing Two-Dimensional Coincidence Doppler Energy Spectra and Evaluation of Electron Subsystem Properties in Metals. *Acta Physica Polonica A* **2017**, 132 (5), 1628–1633 DOI: [10.12693/aphyspola.132.1628](https://doi.org/10.12693/aphyspola.132.1628).
- Ji, J.; Colosimo, A. M.; Anwand, W.; Boatner, L. A.; Wagner, A.; Stepanov, P. S.; Trinh, T. T.; Liedke, M. O.; Krause-Rehberg, R.; Cowan, T. E.; et al. ZnO Luminescence and scintillation studied via photoexcitation, X-ray excitation and gamma-induced positron spectroscopy. *Scientific Reports* **2016**, 6 (1), 31238 DOI: [10.1038/srep31238](https://doi.org/10.1038/srep31238)
- Stepanov, S. V.; Byakov, V. M.; Zvezhinskiy, D. S.; Duplâtre, G.; Dubov, L. Y.; Stepanov, P. S.; Perfiliev, Y. D.; Kulikov, L. A. Premelting as studied by positron annihilation and emission Mössbauer spectroscopies. *Journal of Physics: Conference Series* **2016**, 674, 012018 DOI: [10.1088/1742-6596/674/1/012018](https://doi.org/10.1088/1742-6596/674/1/012018)
- Colosimo, A. M.; Ji, J.; Stepanov, P. S.; Boatner, L. A.; Selim, F. A. Scintillation of Un-doped ZnO Single Crystals. *MRS Advances* **2016**, 1 (2), 121–126 DOI: [10.1557/adv.2015.60](https://doi.org/10.1557/adv.2015.60)
- Stepanov, S. V.; Byakov, V. M.; Duplâtre, G.; Zvezhinskiy, D. S.; Stepanov, P. S.; Zaluzhnyi, A. G. Early processes in positron and positronium chemistry: possible scavenging of epithermal e by nitrate ion in aqueous solutions. *Journal of Physics: Conference Series* **2015**, 618, 012003 DOI: [10.1088/1742-6596/618/1/012003](https://doi.org/10.1088/1742-6596/618/1/012003)
- Stepanov, P. S.; Byakov, V. M.; Zaluzhnyi, A. G. The use of positron spectroscopy for revealing the nanosized structures in liquid mixtures. Identification of n-propanol nanoagglomerates in aqueous solutions. *Russian Journal of Physical Chemistry A* **2014**, 88 (4), 685–690 DOI: [10.1134/s003602441404027x](https://doi.org/10.1134/s003602441404027x)

A complete list of publications is posted on my [Google Scholar page](#).

## Material Research Skills

### Characterization facilities

Positron Lifetime and Doppler Broadening Annihilation Spectroscopy (PALS, DBAR). Atom Probe Tomography (ATP). Scanning Electron Microscopy (SEM). Transmission electron microscopy (TEM). Atomic Force Microscopy (AFM). UV-VIS Spectroscopy. Fourier Transform Infrared Spectroscopy (FTIR).

### Material processing

High-temperature annealing. Wet chemical etching. Electrical Contact Fabrication. Sample polishing.

## Computer Skills

### Software

Scientific packages: Wolfram Mathematica, Maple.

Markup: LaTeX, MS Office Suite, Zotero.

Data plotting: OriginLab, Gnuplot, QtiPlot, SciDaVis, Grapher, Adobe Products.

### Desktop development

Java and Swing, C/C++ and Qt, GNU Automake, CERN ROOT, Geant4, PHP, Fortran.

### UI/UX design

Figma, Sketch, InVision Studio, Adobe XD, Adobe Photoshop, Adobe Illustrator, Inkscape, Blender.

### Frontend

HTML, CSS (LESS and SASS), Bootstrap, responsive web design, JavaScript and jQuery, npm, gulp, CommonJS, AngularJS, React.js and Backbone.js. Google Web Toolkit. WordPress themes development.

## Scientific programs

During my Ph.D. career I've developed a number of desktop software for data analysis and spectra interpretation. The scientific library of my choice is [CERN ROOT framework](#). It offers numerous packages for histogram manipulation, fitting and plotting as well as data storage and graphical user interface classes.

## TLIST Processor

Software is designed to process two-dimensional energy spectra and output one-dimensional coincidence broadened Doppler spectrum. A background fitting and subtraction technique is developed and implemented. [View on GitHub](#).

## SW Calculator

The program calculates S and W parameters of the 511 keV peak of the annihilation radiation. The software estimates the values of the binding electron energies by fitting the CDB spectrum with contributions from e<sup>+</sup> annihilation on electrons with different states and wavefunctions. [View on GitHub](#).

## RooPositron

A flexible terminal-based positron lifetime fitting software. GUI is in progress. The software supports deconvolution of lifetime spectra into the conventional multiexponential model as well as trapping model. Integration of custom fitting models. [View on GitHub](#).

# Conferences

## 18th International Conference on Positron Annihilation (ICPA-18)

Aug 2018

*Orlando, FL, USA*

Oral talk "Positions and Ps in Al<sub>2</sub>O<sub>3</sub> Nanopowders".

## International Workshop on Physics with Positrons (JPos17)

Sept 2017

*Jefferson Lab, Newport News, VA, USA*

Poster "A routine of background subtraction from two-dimensional Doppler broadened spectra".

## 12th International Workshop on Positron and Positronium Chemistry (PPC12)

Sept 2017

*Maria Curie-Skłodowska University, Lublin, Poland*

Poster "Developing new routine for processing two-dimensional coincidence Doppler energy spectra".

## Ohio Photochemical Society Meeting (Oops)

May 2017

*Maumee Bay Lodge & Conference Center, Maumee, OH, USA*

Poster "Developing new routine for background subtraction in two-dimensional coincidence Doppler broadening spectroscopy".

## 58<sup>th</sup> Electronic Materials Conference (EMC)

Jun 2016

*University of Delaware, Newark, DE, USA*

Oral talk "High-Sensitivity Measurements of Defects in ZnO by Means of Digital Coincidence Doppler Broadening of Positron Annihilation Spectroscopy".

## Annual Spring Meeting of the APS Ohio-Region

Apr 2016

*University of Delaware, Newark, DE, USA*

Oral talk "Identification of chemical environment of defects in ZnO by means of digital coincidence Doppler broadening of positron annihilation radiation".

## Ohio Inorganic Weekend

Nov 2015

*Bowling Green State University, OH, USA*

Poster "Approaching Structural Defect Characterization and their Chemical Identification by Means of Coincidence Doppler Broadening of Annihilation Radiation"

## 41<sup>st</sup> Polish Seminar on Positron Annihilation (PSPA-13)

Sep 2013

*Maria Curie-Skłodowska University, Lublin, Poland*

Oral talk "Application of positron spectroscopy for detection of nanostructures in alcohol–aqueous mixtures".

# Scientific associations

American Physical Society (since 2016)

The Ohio Academy of Science (since 2016)

# Professional networks

- Check out my [portfolio on Dribbble](#).
- Look up some of my [code on GitHub](#).
- Find my professional contacts [on LinkedIn](#).
- Get familiar with my [scientific career on ResearchGate](#).
- Skim through a list of my [publications on Google Scholar](#).

# Interests

Linux and open-source software. Fixing cars. Snowboarding and rollerblading.